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ABSTRACT

This paper describes the implementation of a Mastery Learning approach to instruction at Olive-Harvey College (OHC) in Chicago, and outlines planning and operating procedures for its implementation at other institutions. This approach was attempted at OHC as a response to the decreasing abilities of entering students, after many other innovative techniques had been tried with limited success. The Mastery Learning strategy rested on a foundation of fundamental propositions about learning, and seemed specially in accord with the community college's philosophic emphasis on instruction. The paper describes the development of course objectives, establishment of achievement criteria, definition of learning units and identification of learning elements, and the construction of diagnostic tests and prescriptive remedial materials. In general, the Mastery Learning approach has been judged successful at OHC; although some problems have been encountered, a greater level of achievement has been attained by students in Mastery Learning classes. Mastery Learning has permitted traditional group instruction within the fixed academic calendar. It has not required administrative restructuring, complex instructional hardware, curricular change, or a large budget allocation; thus it lends itself to implementation in many different college situations. (BB)

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MASTERY LEARNING:

A STRATEGY FOR ACADEMIC SUCCESS

IN A COMMUNITY COLLEGE

by

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FOREWORD

Professor Jones and his colleagues are to be commended for their attempts to alter the roles of both teachers and students in a community college. They have successfully adapted some of the major ideas in mastery learning to the special circumstances they describe in this report.

In spite of many difficulties and some discouraging first attempts, they have succeeded in bringing a sizeable proportion of their students to relatively high levels of achievement. But even more important than the actual levels of cognitive achievement have been the effects of these procedures in encouraging students to develop more positive views of their own capability as learners.

It is to be hoped that others--teachers as well as learners--will find this report encouraging and will adapt these ideas to their own situation. In my view, the underlying message in this report is that both teaching and learning are alterable and that the effort to develop and use more effective teaching-learning strategies is the central task in higher education for both teachers and learners.

Benjamin S. Bloom

Charles H. Swift,
Distinguished Professor of Education

University of Chicago

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Finally, our thanks to the Mastery Fellows at Olive-Harvey College. Not only did they earn this acknowledgment through their devotion to the restructuring of the courses they taught, but, at the same time, they responded generously to our frequent requests for data and evaluation. These Mastery Learning Fellows include the following: Howard Johnson and Joseph Smith, mathematics; Robert Barkley, Emmett Jones, and Robert Morrow, biology; Rose Stark, foreign languages; Carl Merschel, humanities; Gilbert Schechtman and William McGannon, English; Paul Sunko and Morris Soldinger, accounting; Bert Mendelson, economics; Howard Gordon, social sciences; Arthur Mixon, chemistry; John Ragona, architecture; Ann Taylor and Ishmay Ashford, black studies; Lula Ballton, speech; Joseph Ennesser, instrumentation; Mary Lee, nursing.

MASTERY LEARNING:
A STRATEGY FOR ACADEMIC SUCCESS
IN A COMMUNITY COLLEGE

INSTITUTIONAL PROFILE AND ASSUMPTIONS

Olive-Harvey College, one of the eight City Colleges of Chicago, is a cluster of steel prefabs set down on a prairie near a confluence of superhighways and expressways, almost at the southeastern limits of the city. The college was created by the merger of two branches of City Colleges of Chicago which were housed in wings of city high schools. In merging and moving to the present site in the fall of 1970, the institutions acquired a new name and, the administration hoped, a new identity and capacity for growth.*

Olive-Harvey's brief history has been scarred by the universal problems of emerging and growing institutions in troubled times--internal conflicts, racial unrest, teacher strikes, equipment and space shortages, administrative turnover. Its students, if the truth were told, view it without illusion, keenly aware of the lack of permanent glass and steel, the absence of architectural charm and landscape, the lack of gym and recreational facilities, and the scarceness of extracurricular activities for students--the missing trappings of a real college. For some the educational experience at Olive-Harvey represents compromise, a choice made after a turndown elsewhere, or because of a lack of funds, or in reaction to a failure at some other college. Chicago is, after all, overfull of educational opportunity: the prestigious University of Chicago and the less prestigious, but expensive and desirable, private colleges, which abound; the behemoth University of Illinois Circle Campus; and two large new state colleges, metamorphosed from teachers colleges. In such a context of plenty Olive-Harvey must seem to some an educational "last resort," a place like Frost's "home" where, "When you go there, they have to take

*Olive-Harvey memorializes two Vietnam War posthumous Congressional Medal of Honor recipients, one black, one white: Milton Olive III and Carmel B. Harvey, Jr.

you in." For in the minds of many students the university ranks in the first order of respect among institutions of higher education, the four-year college ranks second, and the community college ranks third.

But on the other side of the coin Olive-Harvey is a college, an institution of higher learning, invested with all the connotational glitter of the phrase. Money, Prestige, Getting Ahead. And it has grown and prospered in response to the demancs of those educational consumers for whom other modes of higher education were really neither appropriate nor available. So, for the letter carrier taking business administration and the ward attendant enrolled in pre-nursing, Olive-Harvey represents Hope, a chance to participate in the bounty which the system offers.

The American Dream, then, is enough to keep most of the customers coming, at least, if not working hard at their books. But for some reflective faculty members and administrators the increasing enrollment following the move to the new campus has not been accompanied by a correspondingly optimistic assessment of the health of our institution. There are clouds on the horizon, and at times the sky seems to be darkening. Our doubts have arisen primarily because of what seems to be an overall decrease in student achievement. This problem is not ours alone. Urban schools and other "front-line" educational institutions share our concern. But coupled with this problem of student achievement is a feeling frequently expressed that the institutional response, not only at Olive-Harvey, but nationwide, is not always appropriate and specific in meeting the challenge posed by the low achiever.

Even now, for instance, despite years of talking about a "student-oriented" community college philosophy, some teachers continue to operate as if their function were to weed out those incapable of doing "college-level" work, shunting them into narrow and short-term career-oriented programs, while culling out for primary attention a small intellectual elite. Some of us have abandoned any faith in our ability to modify human behavior, our historic role; instead, we bemoan the inadequacies our students bring with them to the college. If 70 percent of them can't do anything when they get here, what do you expect? And this leads to the

classic educational cop-out: "Oh, if only the high schools would do their jobs!"

Without complete awareness of our attitudes, many of us at Olive-Harvey and in similar educational situations, increasingly disappointed, perhaps, in the "quality" and performance of our students, have become alienated and apart. We see ourselves vis a vis the students in much the same way as students have traditionally viewed their relationship to professors--not quite hostile or belligerent, but characteristically competitive, a relationship in which there is a diversity of interest. Students try to "get" high grades. Teachers, on the other hand, are responsible for establishing the expectations, obstacles, and impediments making the students' task difficult. Some teachers have expressed this as "keeping standards high." Others see their role as one of separation and selection, of weeding out those who can't make it. This function, Ivan Illich suggests, has become the major goal of our educational system: to designate and credential and certify. Such an orientation does nothing to discourage the teacher's belief in the sanctity of the "normal curve" of ability and accomplishment. On the contrary, it encourages the teacher to devise some means, any means, to preserve and measure the differences in accomplishment of his students.

Many of our teachers, we feel, have learned to live with failure, their students' and their own. They have acquiesced, are resigned. Failure is expected, and the teacher is not disappointed. If, indeed, one starts with the assumption that some students "have it" and some don't, it is not difficult to conclude that what is done in the classroom is of little consequence and the inevitable will occur, regardless.

Though teachers sometimes feel that they are at the end of everybody's foot, in reality our teachers function with little supervision or evaluation. The administration does little in the way of judging their classroom performance. Their peers leave them strictly alone. And, God knows, their students do not begin to be critical. Under such circumstances, what incentive is there for the ordinary teacher to maintain effort and systematic endeavor, particularly if the teacher anticipates that student failure will

follow under any circumstances?

Naturally such an institutional response to a population of confirmed low achievers produces the inevitable results which causes us concern: high rates of attrition and failure, dissatisfied and frustrated teachers, alienated students, and general despair.

And the prospect for "better," that is, more able, students is not encouraging. If anything, the prospect is that we will increasingly serve students who are judged poor learners by conventional criteria. Nationwide efforts to make higher education available to a much broader segment of the population have brought into the community college an increasing variety of students with a broader range of abilities and talents. Our students come from the public schools of Chicago, and everyone knows what is happening in urban public schools. Moreover, the superfluity of educational opportunity in the metropolitan area and the state, and Olive-Harvey's low rank in the pecking order of educational institutions, have resulted in a siphoning away of the educationally able. In fact, one suspects, the competition for students is causing the other colleges tc "dip lower" each year.

The raising of educational expectations for all people has created a demand for and utilization of educational resources by people who would not have been considered "college material" fifteen or twenty years ago. The majority have histories of low achievement. Some have not completed their secondary education. Many have not yet formulated long-term goals. And these students gravitate to Olive-Harvey. More specifically, our Olive-Harvey students have the following characteristics, tabulated and described by our office of institutional research: 95 percent are members of some minority group and most of these are Afro-Americans. The median age is a surprising twenty-six. Only 40 percent of our students are single, and at least half of them have children. About 40 percent of the entire student body has had military service. Our students tend to be self-dependent and self-supporting; 63 percent of them live in their own households. The 1973 median income was in the $7,500-$9,000 range. Sixty-seven percent of all students are employed, primarily in clerical, white-

collar, or civil service jobs. The two largest categories of employment are health services and government. These statistical descriptions have tended to remain stable from year to year.

Students we have, but these students bring with them expectations we do not meet. We promise, but to an increasing number of these diverse students we don't deliver. We do not provide the experiences which help them learn; they do not achieve the self-improvement they seek; and our society fails to receive the benefits of the increased competence in its citizens that heavy investments in education are intended to produce.

We do not pretend that these concerns are ours exclusively. Informal faculty chit-chats, departmental meetings, formal college committees--all, to a greater or lesser extent, become forums in which the participants reveal a widespread awareness of and sensitivity toward the problem. And the response is not always talk or resignation or blame. Many projects and programs have arisen in the past two or three years to cope with student failure, from a simulation approach in one social science course to an extensive remedial reading program involving the entire English department. Some of these efforts to improve student performance have been effective; perhaps more of them have not. In retrospect it seems to us that much of what has been done has depended on a technological aid--a "gimmick"--without making a fundamental change in the concept or approach to the learning task.

The "Mastery Learning" strategy that we describe in this paper rests, on the other hand, on a foundation of fundamental propositions about learning and learners which we have come to believe and which we share with our students. These assumptions deserve explicit description here since they are central to our purpose and since they seem to be empirically borne out by our results.

First is our faith that perhaps 90 percent or more of our students, those falling generally within what is characterized as the "normal" range of aptitude and intelligence, <u>can</u>, given appropriate instructional conditions, learn at a very satisfactory level what we have to teach. (See Bloom, 1974, for an exposition of this position.) In truth, the curriculum

or our schools is not so remote, arcane, exotic, or unattainable that virtually everyone, given adequate time, cannot learn it, although we, as practitioners of the mysteries, would like at times to feel a certain exclusiveness, perhaps. In fact, far from finding the idea of universal high achievement hard to accept, we should be incredulous when confronted with the evidence of widespread failure.

Directly related to this assumption is the corollary that the basic purpose of education and of the teacher is to maximize the achievement of each student--to facilitate student success. Although this goal would seem self-evident, far too often practice reveals that we seek to selectively serve only an academic elite, functioning as a screen through which they pass.

Third, we are generally agreed that successful educational outcomes are not haphazard, random phenomena. Though we do not discount the importance of inspiration and spontaneity in good instruction, we do not believe that "the seat of the pants" and "the top of the head" are superior to planning, system, and organization in helping students learn. More specifically, we believe that most people learn best when the goals of learning are well defined; when learning tasks are divided into manageable, properly ordered units of instruction; and when the instructor has sufficient feedback from each student to remedy or immediately correct failures which arise throughout the program of instruction. Students learn at different rates and in different ways. Different students respond best to different presentations and materials. Consequently, though group instruction may be an administrative necessity, such instruction requires a supplementary individualized component to serve individual needs.

We share the widespread assumption that affective or emotional factors and attitudes have an important bearing on educational achievement; therefore, we seek instructional strategies which promote a healthy self-concept in the learner. As a matter of obvious fact, "success" in the classroom encourages and sustains the kind of attitude without which success is not possible. One student in our program remarked that her teacher had "psyched" her into an A, as if she were surprised or as if

she had been enticed and betrayed. Learning, after all is a function of the psyche. Listen to the articulate players and coaches before a Super Bowl game. Their concerns are rarely physical or strategic; the edge that they claim is always "mental" or attitudinal. No one doubts that achievement is very much a function of how one sees himself and how he feels.

Finally, we believe that the evaluation of student performance and its accompanying grading system are most meaningful and valuable when they assess growth or movement toward predetermined instructional objectives rather than compare students' performances. We are principally concerned with what and how much Johnny learns, not with whether he knows more or less than Sally. Assigning grades in the traditional percentages to maintain the distribution on the bell-shaped curve is hardly compatible with our assumption. In our view, if everyone masters the learning task as we define it, then everyone is awarded an A.

A related proposition is that students not directly competing for a limited number of As and Bs might well make a constructive, collective effort to help each other and improve everyone's level of achievement. Similarly, the view of the teacher as the person who gives out the limited prizes in a contest and who is therefore to some extent an antagonist--might be transformed so that the teacher becomes a helper whose role is to assist students in a joint endeavor to achieve mastery, an enterprise with an unlimited supply of rewards (As and Bs) for those who succeed.

These assumptions, though not always consciously prominent, make up the basic theoretical framework within which our inquiry has taken place. How these assumptions influenced our study and were in turn affected by our experience constitutes the essence of this manuscript.

A systematic approach to learning has worked for us at Olive-Harvey. Even more important, it shows promise of contributing to greater and more widespread student achievement in the coming years as it spreads, not by administrative fiat, but simply through the interest of our teachers and the recognition that a systematic approach to learning--call it Mastery

or what you will--can make teaching more effective and gratifying.

Our purpose in writing this educational brief is simply to show others how we attempted to cope with a particular problem at Olive-Harvey College. We believe, of course, despite the wide range of conditions which prevail from college to college, that our method, or one like it, has promise for others. Mastery learning, as it is commonly called, is a "systems" approach to learning, but, unlike others, it requires no comprehensive administrative restructuring. No large sums of money are necessary. Orientation of interested faculty can be carried on through a simple inservice program. Hardware is not necessary, though it can be used. All teachers need not participate, only those who wish to. New books are not required; old materials can be employed. Boards and administrators need not be consulted; deans don't have to nod approval; faculty councils need not deliberate; curriculum need not be reshaped. In truth, if a teacher wants to apply this strategy or one like it in his classroom, all he must do is make some simple modifications in his planning and in his own and his student's behavior. Like Professor Bloom, a leading proponent of Mastery Learning, we believe that most students can attain a high level of academic achievement if instruction is approached systematically, if objectives are defined, if students are helped when they have learning difficulties, if they are given sufficient time to achieve mastery, and if there is some clear criterion of what constitutes mastery.

We hope that what we have done and are doing may be useful to others in their efforts to improve instruction. We especially hope that our message will reach our colleagues in community colleges who share so many problems with us and who constitute the professional instructional nucleus of the fastest growing segment of the nation's educational establishment.

However, though our experience has been with community college students and the Mastery Learning strategy seems peculiarly in accord with the community college's philosophic emphasis on instruction, there is every reason to believe that the experience and analysis here reported are, indeed, relevant and applicable generally to the problem of improving instruction in higher education.

BEGINNINGS

Experimentation and innovation have been very much a part of the Olive-Harvey educational program, particularly since the move to the new campus. Though teachers are sometimes considered a conservative group, at our college several factors were encouraging them to be more daring. Not the least of these was the challenge posed by the decreasing ability exhibited by entering students, a problem to which we have already referred. In addition, we were undergoing much general growth and change. New faculty with new ideas were rapidly being added to serve increasing enrollments. New departments were being created. The racial composition of the student body was changing significantly, with accompanying student pressure for curriculum change. And all of this ferment was occurring in the context of a union contract--one of the most progressive and liberal in the country--which allowed for much teacher autonomy and experimentation.

It was not surprising, then, that new resources had been tried--some passing, some enduring. The foreign language department had used laboratory facilities with a highly sophisticated wireless instructional system for individualized teaching. Seminars, independent study programs, and programmed instruction were employed in the humanities department. Social sciences instructors experimented with simulation techniques. A large-scale tutorial program was inaugurated in the business department. A Wang Electronic Calculating System was installed as the nucleus of a mathematics laboratory; English, too, equipped a lab with reading hardware and software and staffed the room with tutors. And the nursing department set up a summer work-study program for first-year students.

Many of these efforts had some positive effect on student achievement. However, inevitably there were shortcomings. Some of these innovations required special funding, and they faded once the source dried up. Others were successful under the impetus of an energetic faculty member, but lost steam after the disappearance of this individual or his enthusiasm. Most

suffered from having a very limited application--to a particular discipline or a particular group of students. We sought a solution which could be applied more generally and systemically.

In trying to improve instruction we came again and again to a basic element: the nature of the student. When personal attention was paid to particular students with problems, we noted, they were often able to overcome learning difficulties. Students who sought out counselors, for instance, seemed to improve academically, unlike those who sat in dim silence waiting for the final examination ax to fall on their heads. Those who came to instructors' offices frequently could be helped. Those who voluntarily used the English lab and took advantage of the peer and teacher tutoring tended to write better papers.

An outstanding example of an "academically aggressive" student came to mind from some years back. This student, who ultimately completed a Ph.D. at a major midwestern university, came from rural Arkansas and tested at somewhere around the 17th percentile in language skills on the English placement test. Three and a half years later, as he was preparing to graduate from a local teachers' college as valedictorian, the chairman of our English department asked whether he would retake the entrance skills battery. The student scored little better on the language abilities test, as, in fact, he had predicted. "I bother people," he explained to the puzzled department chairman. "When I have to write a paper, I bother people. I write it; then I have a faculty member read it; then I rewrite it. Then my sister 'proofs' it. And I show it to someone else and we go over it and I do it again." Contrary to what many of us think, sheer effort, or perseverance as Carroll (1963) defines it, can compensate for weaknesses in learning as in other areas of endeavor.

This student was "aggressive," whereas most of our students have been generally passive and sedentary. As they saw it, their role was to attend, to hear, to receive; not to contribute, to question, to initiate. They did not, as a rule, open their mouths, because to do so meant risking something. They rarely sought help or clarification from the instructors. Our office hours were student-free for the most part. In fact, one

instructor threatened to institute a union grievance against his office mate, who insisted on dragging students bodily inside the room. The instructor argued that bringing students to the office constituted a "violation of established working conditions." Alas.

Students who got personal help did seem to us to do better. If students did not speak out (and they did not), it was extremely difficult to find out what was going wrong, where we had failed in helping the master the learning task. Quizzes and tests helped; but what was their value if the student merely sighed, "Another loser" when he received the results and filed them away in his briefcase? The personal, "student-tutor" approach seemed to hold some promise for solving our problem. Yet even when tutorial services were made available on a voluntary basis, they were little used, we found.

We began, then, to focus less on particular innovative techniques and more on patterns and approaches which were applicable beyond a single discipline or course and which showed promise of helping our students learn. One of our colleagues, Emmett Jones, a biology teacher and administrator, had been, since 1968, a graduate student in education at the University of Chicago. While there, Emmett had been exposed to Mastery Learning strategies for raising student achievement. He had, in fact, been taught test theory by the Mastery approach. His response as a teacher and student was strongly enthusiastic, and it was only natural that he began to discuss and investigate the possibility that such a strategy might help our students at Olive-Harvey.

We explored various kinds of Mastery Learning. Some of them allow self-pacing by the student, who can finish a course in six weeks or in twenty weeks. We did not feel that these programs could be well accommodated by our calendar limitations; nor did we believe our students would adapt to self-pacing. Other kinds of Mastery Learning were largely autotutorial and again demanded more motivation and perseverance than we felt we had a right to assume in our students. An alternative proposed by Dr. Bloom at the University of Chicago seemed to fit our situation best because it permitted traditional group instruction within the fixed academic

calendar unit. Emmett Jones began using this form of Mastery Learning with his biology classes, and in 1972 he began to coordinate efforts to expand such instruction throughout the college.

At first he merely circulated information about Mastery Learning and his own experience with it. When teachers in other disciplines expressed an interest in similar experimentation, Emmett, in cooperation with our administration, started a formal project designed to facilitate the testing of Mastery Learning in other areas of our college. To our good fortune, Federal Funds under Title III of the 1964 Higher Education Act have been allocated to "buy" some of the preparation time that participating faculty members have needed during the summer of 1972 and subsequent summer terms.

These Title III funds over the course of three years amounted to more than $150,000. If the acquisition of such a sum for "start-up money" seems a significant impediment to those of our colleagues who might wish to implement similar programs in their colleges, particularly in these days of budget restriction, let us put their minds at rest. Much of this money went into administering and evaluating the program. We believe that a Mastery Program can be implemented without any budget allocation, though this statement may sound hypocritical coming from those of us who have enjoyed a summer or two of fully compensated employment preparing for our classes in the Mastery Program. Many colleges, for instance, have an inservice program. Mastery Learning could be the subject matter of such a program. An entire faculty could be oriented in a weekend workshop or in four or five inservice presentations. Many boards reward the educational activities of their faculties with tuition reimbursement; other colleges have special training programs for their faculty in cooperation with branches of the state university. These resources could easily be used to introduce Mastery Learning to a faculty. And any department within a college could institute its own program. Finally, we firmly believe any single faculty member might easily adapt the method or strategy to his own course. We have, incidentally, run across single faculty members who have done just that--at other campuses of the City Colleges of Chicago,

at the University of Michigan, and at other institutions.

Operationally, after all, Mastery Learning has no added cost. No special materials (other than those developed by the teacher) are required; no equipment is necessary. The basic class-time structure and teacher-student ratio prevail. The change is in the internal organization of the individual class. If funds (or the lack of them) are not a barrier to the inauguration of a Mastery Program, neither are any of the other agents that are generally thought of as obstructions to teacher-initiated change within a community college or other educational institution.

We have already had occasion to speak of our union, Local 1600, AFT. It is certainly one of the strongest locals in higher education in the country, having heavy strictures against unilateral change if established practice is modified to the detriment of the teachers. In the case of Mastery Learning at Olive-Harvey, no one sought approval from the chapter's Working Practices Committee chairman. No significant working practice was changed--class hours, contact time, class load, and student load remained the same for the teacher.

And the same situation prevails with regard to our administration. We sought no "check-off" from anyone, from the department chairman through the dean. If any principle remains sacred in the ambiguity of values in education today, it is the right of the teacher to exercise his prerogative within the classroom. Every change by a Mastery teacher was instituted at the classroom level, in his own domain.

An important principle of Mastery Learning is that the desired change in student behavior is at the discretion of the teacher; that to justify inactivity or indifference by citing the influence of outside forces--the parent, society, the secondary school, the student's innate ability--is, in the vernacular, a "cop-out." Similarly, one cannot blame inside forces. Money is not necessary. Approvals are not required. The changes we describe are well within the power of the individual teacher.

What the Title III allocation accomplished was to allow us to offer to selected teachers a powerful motivator, summer employment. But, though

employment may have been the primary motivator, our Mastery teachers have quickly become sold on the value of this strategy in improving their performance and have continued to use Mastery techniques in their current classes and to adapt them to new classes.

During 1972-73 four faculty members, two in mathematics and two in biology, participated under Emmett Jones' directorship. In 1973-74 there were nine new faculty members, and in 1974-75 seven more. The following disciplines were represented: applied sciences (architecture and electronics), nursing, speech, black studies, English, humanities, accounting, social sciences, economics, foreign languages, and chemistry.

In each case the Mastery Learning Fellow devoted eight weeks of summer to preparation and the subsequent school term to a controlled experiment with the Mastery strategy. In the next chapter we shall consider more specifically what the Fellows did in both the planning and operational stages.

At the time of this writing the results of the 1974-75 experiences with Mastery Learning have not been analyzed and are therefore not included in this paper.

PLANNING

Success in any complicated enterprise is rarely a result of sudden insight or dramatic breakthrough or some unique ability in the entrepreneur. Rather it is a consequence of a series of decisions and actions, each undramatic in itself, which collectively produce a superior result. Some years ago Life magazine profiled the nation's leading gardener. Surprised by the honor, the lady confessed to no "secrets" of the soil, no formula to explain the miracle she could create on half an acre. Her achievement, she admitted, was the result of quite ordinary activity--fertilizing, planting, weeding. She did what others did, but in a meticulous, careful, and systematic way. One felt a kind of disappointment in reading her garden regimen. There was no magic or legendary "green thumb."

As we consider the results of our application of Mastery Learning to our classes at Olive-Harvey, we are struck by similar feelings. What, after all, is there to say? There is nothing esoteric or dramatic in what we have done. We have presented material, discussed it, tested, remedied weaknesses, retested. We have done what teachers and students have done for centuries. At most we can say that we have done these things with precise care. It is the organizing and patterning of our activity that have strongly contributed to greater achievement in our students. Anticipating, then, that a detailed description of the programs operation may have little to tell the reader, we feel that some attention should nevertheless be given to such a description.

Specifying the Objectives and Content of Instruction

Mastery Learning presupposes that instructor and learner are aware of clear and well-defined objectives, the attainment of which constitutes mastery of the course content. Participants in the Mastery Program were not required to change the content or objectives of the course as they traditionally taught it; they only needed to specify their means and their goals. Such a purpose could be well served by defining objectives behaviorally, though some teachers chose to state them more loosely and some

subject matters did not lend themselves to behavioral terms. The objectives of a course in composition were stated as follows:

A. To understand and use established manuscript procedures (related to size of paper, margins, and so on). To follow standard practice in grammar, punctuation, spelling, and idiom.

B. To understand what is meant by structure in writing and to employ this knowledge in structuring short expository prose. To employ a topic outline as a structuring tool and to be able to construct topic outlines which are mechanically correct.

C. To understand the concepts subject, limited subject, purpose, and thesis. To utilize these concepts explicitly in the writing of short expository prose.

D. To understand that a paragraph is a logical unit. To understand the concepts topic sentence and paragraph body and to be able to produce a topic sentence and construct a unified paragraph of at least four or five sentences.

E. To know and use these devices for beginning and ending: statement of thesis, anecdote, the question, summation, repetition of topic sentence, and others.

F. To understand what is meant by cliche in the use of content and to employ, insofar as possible and appropriate, fresh, personal material and a unique point of view in writing. To learn to value the unique, the personal, the particular--as opposed to the meaningless or trite abstract. To overcome the inhibitions which prevent personal reaction in writing.

G. To understand these concepts as they relate to diction in writing: concreteness, abstraction, idiom, denotation, connotation, context. To employ appropriate and precise diction in writing.

A math teacher formulated his objectives more strictly, defining the desired terminal behavior of the student in terms of what he should know and what he should be able to do. For instance:

The student shall demonstrate an understanding of the set of whole numbers by (a) knowing by name the axioms of equality and order, (b) identifying the distributive law, (c) being able to compute the cardinality of a set.

The principal objective of a unit in biology was stated as follows:

You will demonstrate an understanding of both the chemical and physical properties of matter by being able to identify, from given descriptions, the three systems of solids within a liquid--suspension, solution, and colloid.

Preparing Final or Summative Examinations

Each mastery teacher prepared one or more summative tests to find out how well the students had learned the specified material and to use in grading. In most cases the faculty adopted forms of final exams that had been administered in the past. Some instructors elected to give one test at the end of the semester; others chose to administer two or more at appropriate intervals. In all cases, however, these examinations were used to summarize the student's achievement of the stated objectives and thus determine his final course grade.

The use of the Mastery strategy did not, however, remove the flexibility in testing that teachers had enjoyed in the past, nor did all teachers use a traditional objective test as a final measure. In English class, the average grade on four final student papers became the final grade. Another composition teacher graded the student on a final "in-class" theme and on an objective test of rhetorical principles. In an accounting class take-home problem-solving tests were employed. A teacher in humanities used a midterm essay and a final objective test.

Establishing of Achievement Criteria

Each participating teacher determined what level of achievement constituted mastery. This decision was very important, because in our strategy students are told at the very beginning what achievement levels are expected for awarding final grades. A consensus was reached among all mastery teachers that criterion-based standards (Bloom, Hastings, and Madaus, 1971) would be used. Each teacher, then, arrived at his own absolute standards from previous experience with students in his particular course. In most instances, the established grades of A, B, C, D, and F were based on the same performance levels reached by students in previous years on a parallel form of the Mastery summative examination. Thus, theoretically--and, in fact, realistically--every student might expect an A if his achievement came up to predetermined standards, whatever his standing relative to others in the class.

Defining the Learning Units

As a means of systematizing instruction, the course materials were broken down into a sequence of smaller learning units. Though many teachers, we found, had incorporated aspects of the Mastery strategy into their day-to-day teaching in the past, very few had ever really formalized units of instruction with specific objectives for each unit. There was nothing mysterious or difficult about making these unit divisions. In some cases units could simply correspond to chapters in a text. In other instances a unit is well defined by previous practice or, in the case of vocational programs, by the demands of professional certification. Sometimes units were formed out of convenient time periods. Generally a unit involved about two weeks of learning activity followed by a formative (diagnostic) test to determine what the student had or had not mastered.

Examples:

An accounting teacher constructed nine units corresponding to chapters in the text.

A math teacher listed the following six units: elementary set theory; further understanding of the set of whole numbers; the set of integers; the set of rational numbers; further understanding of the set of rational numbers; polynomials.

An instrumentation course contained seven units, including number systems, counters, and measuring instruments; basic electrical laws; and the bridge circuit.

An English composition course had five units on rhetorical principles, such as structuring a composition, choosing appropriate content, and diction. Papers written by students during these instructional units implemented the principle being taught. Four more units in the same course utilized classroom discussion topics to provide the content for an assigned paper--one on Richard Wright's Black Boy, one on work and employment, one on education.

Identifying the Learning Elements

All Mastery teachers were encouraged to analyze each unit of instruction into its constituent elements. Some of these might be the ability to recognize or define basic terms--membrane, or set, or iambic, for example--and the ability to properly identify objects. Other elements might be facts: the relative hardness of rocks in relationship to one another, for instance, or the birthdate of William Shakespeare. Rules, particularly of procedure, are possible elements. The proper order in which to perform arithmetical operations in an equation is an example, or the way in which a multisyllabic word should be hyphenated.

Comprehending principles and applying them are "higher level" cognitive functions that in most cases presuppose mastery of terms and facts. Thus it will be seen that these elements constitute a hierarchy. Such an intensive analysis of course content, though troublesome to the teacher, is important, because the result is a clear indication of what elements must be taught and tested and how they are related.

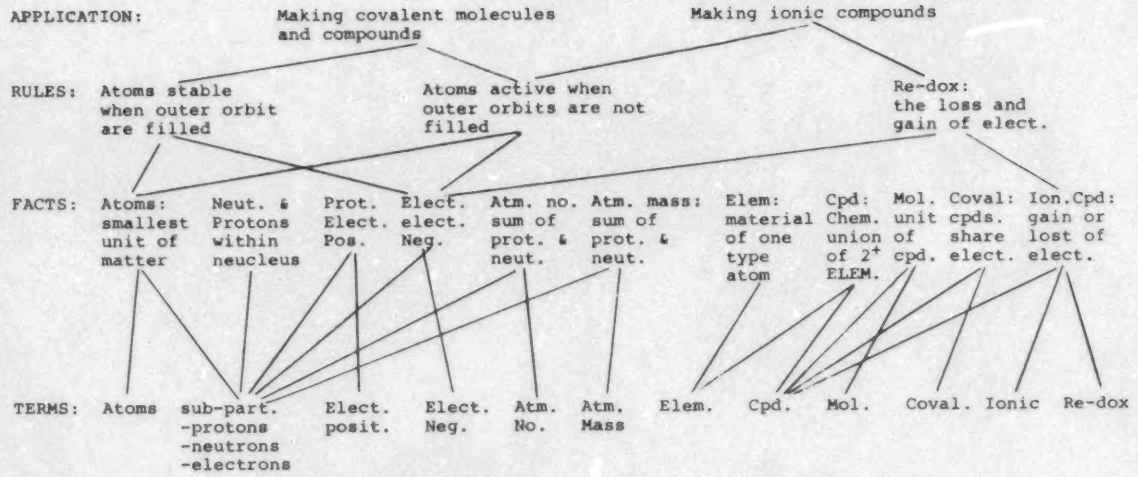
To identify the learning elements and understand their interrelationships, some teachers constructed "strings"--charts showing the elements and how they connect. Two such strings are reproduced here--one from a plan for a biology course and one from English.

The biology teacher has isolated four kinds of elements which constitute the learning content of a unit on "Elemental Composition of Living Systems" (Figure 1). The first elements he calls terms and the kind of learning associated with them is definition and identification. At the next level, the student should recognize and be able to repeat fundamental statements--facts--about the nature of the substances identified under terms. Then come rules and, finally, applications. These latter elements designate operations and processes which the student is to learn.

The interdependence of these elements is shown by connecting lines. The student must learn what a compound is before he can understand the fact that "covalent compounds share electrons." This fact, in turn, must precede his learning the application, making covalent compounds. Though

FIGURE I. Plan for Action

"ELEMENTAL COMPOSITION OF LIVING SYSTEMS"



the lines show interdependencies within a unit, lines could be drawn from "string" to "string"--unit to unit.

Figure 2 reproduces a "string" used to plan a unit on the structure of a English composition.

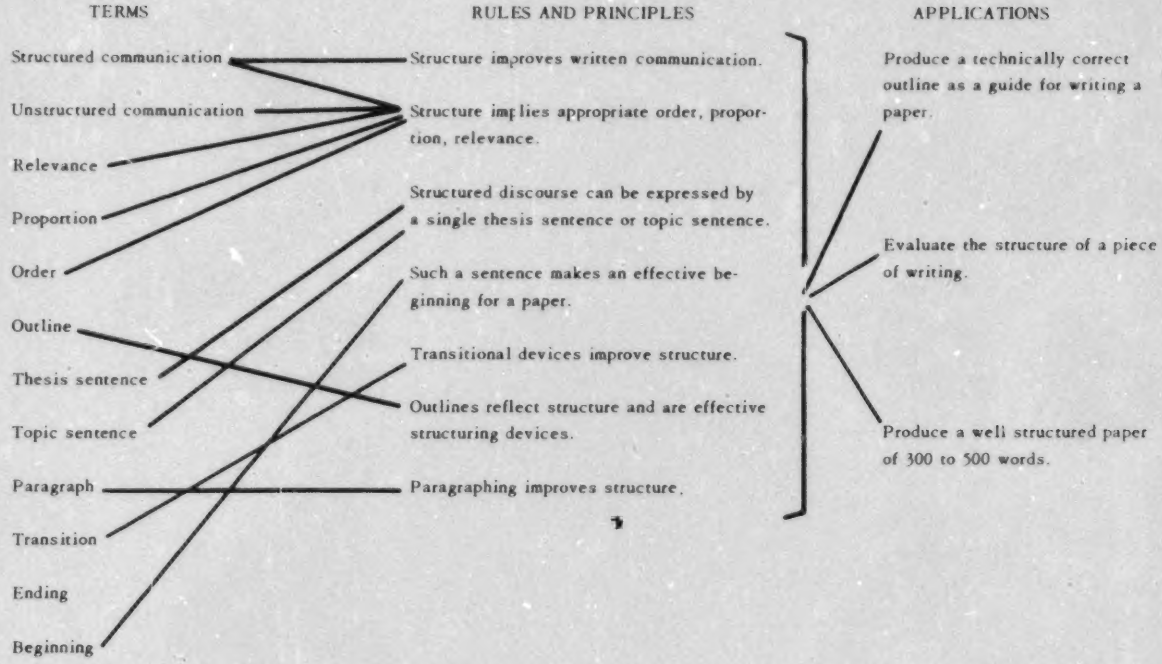
It should be clear that though we have presented these preplanning steps in a chronological sequence, they are interdependent. An examination of elements within a learning unit affects the teacher's decisions about course objectives, summative testing, and achievement criteria, for instance.

Constructing Formative Tests and Correctives

For each learning unit our teachers have constructed a brief diagnostic test or formative evaluation instrument. For those students who demonstrate mastery (usually 85 percent correct responses) no further work on the unit is necessary. For the others, these tests reveal specific points of difficulty and simultaneously prescribe what they might do to overcome their weaknesses. These prescriptions for remedial work, or correctives, as we call them, can be written beside or below the test item, directing the student to a page in a textbook, to a film strip, to some reference material, or to some other resource that explains the specified concept or idea that he failed to perceive or apply when he took the formative test. This feedback mechanism built into the formative tests is perhaps the most important single factor of the Mastery Learning strategy in that it directs the students to alternative kinds of instruction--modes of learning that supplement group-based instruction.

Each learning unit, then, contains original instructional materials that are group-based, a diagnostic progress test, and recommended alternative instructional materials that are individualized. A parallel form of each diagnostic test for each unit is also constructed, to be administered to those who have failed to achieve mastery on the first test, but who, it is hoped, will demonstrate mastery after they complete the required correctives.

FIGURE 2. PLAN FOR A UNIT ON THE STRUCTURE OF AN ENGLISH COMPOSITION


TERMS
RULES AND PRINCIPLES
APPLICATIONS
Structured communication
Unstructured communication
Relevance
Proportion
Order
Outline
Thesis sentence
Topic sentence
Paragraph
Transition
Ending
Beginning
Structure improves written communication.
Structure implies appropriate order, proportion, relevance.
Structured discourse can be expressed by a single thesis sentence or topic sentence.
Such a sentence makes an effective beginning for a paper.
Transitional devices improve structure.
Outlines reflect structure and are effective structuring devices.
Paragraphing improves structure.
Produce a technically correct outline as a guide for writing a paper.
Evaluate the structure of a piece of writing.
Produce a well structured paper of 300 to 500 words.

Sample pages from a unit test in biology and from one in social sciences are reproduced as Figures 3 and 4. As corrective prescriptions the instructors have provided references to the original text or to an alternative text. If the student misses the question, he knows how to prepare for a retake.

Besides the more traditional correctives--references to a text--teachers have employed many other means of helping students who did not demonstrate mastery. Some placed tapes in the Learning Resources Center for students to use at their leisure. As described in the next section, peer tutoring and study groups were used. And, of course, teacher conferences have been prescribed for those students who could benefit from them.

FIGURE 3. SAMPLE QUESTIONS IN A UNIT TEST IN A SOCIAL SCIENCE COURSE

1. Assuming a population of 20,000 people and a G. N. P. of $10,000,000, the value of the per capita output would be

Heilbroner

a) $500
b) $5,000

p. 2

c) $.002
d) $2,000
e) None of the above

2. The idea that poverty is a relative concept is best illustrated by which of the following statements?

Heilbroner

a) Poverty is a universal phenomenon.
b) Poverty is based on the standard of living found in different countries or areas and is, therefore, different in different places.

p. 3

c) Poverty is poverty no matter where it is.
d) Poverty is caused by a defect in the system of distribution.
e) Poverty can be eliminated.

3. Considering the many serious problems confronting the American economy, the fundamental question to which Mr. Heilbroner's book is directed is:

Heilbroner

a) Can the American economy continue to produce sufficient quantities of goods in the face of ever increasing population growth.

p. 11

b) Can the many problems posed by remedied without dismantling the existing American capitalistic system and replacing it with something different.
c) Can American capitalism acquire sufficient foreign trade to overcome its internal productive deficiencies.
d) Can the many economic interests in the American economy remain sufficiently compatible to continue performing the basic economic functions.

4. In 1970 the gross national product for the first time in history reached

Heilbroner

a) $1,000,000
b) $1,000,000,000

p. 3

c) $1,000,000,000,000
d) $1,000,000,000,000,000
e) None of the above

FIGURE 4. SAMPLE QUESTIONS IN A UNIT TEST IN BIOLOGY

5. The mass (weight) of each proton is

   A. zero
   B. one
   C. two
   D. twice that of an electron
   E. twice that of a neutron

   (Kimball, p. 9; Ford & Monroe, p. 23)

6. The mass (weight) of each electron is

   A. virtually zero
   B. one
   C. two
   D. 1/12 the mass of a carbon atom
   E. the same as that of a proton

   (Kimball, pp. 6, 9; Ford & Monroe, p. 23)

7. The atomic number for carbon is

   A. 6
   B. 20
   C. 12
   D. 29
   E. 17

   (Kimball, p. 7; Ford & Monroe, p. 24)

8. A material made up of one kind of an atom is called

   A. a compound
   B. a molecule
   C. an element
   D. a covalent compound
   E. an ionic compound

   (Kimball, p. 4; Ford & Monroe, p. 23)

9. Covalent compounds are formed by the

   A. loss of electrons
   B. loss of protons
   C. gain of electrons
   D. gain of protons
   E. sharing of electrons

   (Kimball, p. 11; Ford & Monroe, pp. 27-28)

OPERATING PROCEDURES

Each teacher in our Mastery Program taught at least two classes in the same subject, a Mastery and a control class. The objectives, curriculum, presentation, and achievement standards of the two groups were the same. The distinctive treatment of the experimental group is the primary focus of our discussion here.

Students were admitted randomly, to both experimental and control classes, through normal registration procedures. The sections selected as Mastery Learning classes had not been identified as such or given any prior publicity. It was assumed, then, that students were normally distributed into the class sections with respect to prerequisites or cognitive entry behaviors and other characteristics. The experimental and control classes had the same instruction as well as the same instructor. To put it another way, each mastery teacher served as his own control. In most cases the teachers taught both an experimental and control section in the same subject during the fall semester, and only experimental classes in subsequent semesters.

The teachers of the experimental classes spent time during the first few sessions orienting the students to the program. Students were assured that the teachers had changed their own attitudes regarding human learning potential to the extent that all students were expected to receive A's. Students were also asked to develop a positive attitude toward their potential for high achievement. During this orientation period the teachers distributed materials specifying course content, stating course objectives, and establishing absolute grading standards.

The statement specifying course content included reading and laboratory assignments, audio-visual experiences, and field trips. Although instructors used various organizational frameworks, in all cases the concept of sequential learning was emphasized. Sometimes orally and sometimes in written form, students were advised that achievement at a high level on Unit #1 provided the cognitive entry behaviors (prerequisites) necessary for mastery of Unit #2, that mastery of Unit #2 would establish the basis

for success in Unit #3, and so on. It was further emphasized that developing the prerequisites constitutes a necessary link between the learner and the accomplishment of the learning task; and without the prerequisites learning is very difficult if not impossible.

At the outset students were informed of the types of behavior expected at the end of the instructional period. In some instances course objectives were presented in a unit-by-unit progression. In other cases, objectives, although specified, were presented generally without regard to unit order.

The students were told from the very beginning that, inasmuch as criterion-based standards had already been derived for the class, they were not competing with each other for grades based on their rank order in the class. Instead, the proportion of students receiving each grade was to be determined by their performance levels relative to the established criterion. For example, to receive an A in the economics course a student had to answer at least 80 percent of the questions correctly on the final (summative) examinations; in biology an 85-percent score was rewarded with an A. (These standards were derived from past student performances.) All students could receive A's or, conceivably, all students could receive F's. The students were encouraged to become cooperative, rather than competitive, in their relationships.

In addition, the students were informed of the avenues available for demonstrating achievement. In the majority of cases, their score on one or more summative examinations was the sole determinant of the final grade. However, some teachers awarded credit--about 10 percent of the total--for written homework, active or overt classroom participation, and achievement on the formative or diagnostic tests.

To promote cooperation, the students were encouraged to:

1. Utilize the services of the college-paid tutors available for certain courses.
2. Form outside study groups containing three to five members with mutual interests. They were encouraged to exchange

telephone numbers, call each other for assistance, arrange mutually convenient hours for studying together, and supply lecture notes in the event of absences.

3. Organize in-class peer study groups. Some teachers set aside fifteen to twenty minutes about every two weeks, at the end of a class period, to give the students an opportunity to compare performances on examinations and tests and to alleviate or overcome learning difficulties among themselves.

The mastery students were also told about the brief formative or diagnostic tests to be given after each learning unit. It was explained that the tests would not be used for assigning grades; instead, they were viewed as an important step in the instructional process, as a way to measure both student achievement and teacher effectiveness and to identify problem areas. These difficulties could then become the object of various corrective "prescriptions" of which the students could select one or more.

The units were taught using traditional group-based instructional methods. However, at the end of each unit the diagnostic-progress test was administered. The students recorded their responses twice, once on each half of an answer form. One half was passed to the instructor and one half was retained by the student. Correct answers were then given by the teacher and each student scored his own test. Questions pertaining to the test were elicited from the students, and concepts were clarified. The instructor later scored his half of the answer sheet and recorded the result for statistical and test-analysis purposes.

Those students who scored below the mastery level were directed to use the prescribed correctives and cooperative measures to overcome their difficulties. At the beginning of the next class section a parallel form of the diagnostic test was administered. In some cases, because of time limitations, the students were permitted to take the "retakes" at home. Other instructors put the retakes in the Learning Center where they could

be proctored whenever the student wished to take the test.

The teachers then proceeded to the next units, following a similar course of presentation, diagnostic testing, corrective procedures, and re-testing.

At the end of an appropriate number of units, final or summative examination was administered. One to four of these exams were given during the term, depending on the teacher's preference. Appropriate final course grades were determined by the students' performance on these examinations.

Many times during the semester the Mastery teachers met as a group to discuss problems, share experiences, and evaluate progress. At the end of each semester a large body of data was collected for use in evaluating the effectiveness of the strategy. A summary and analysis of these data appear later in this paper.

In an effort to infuse the process with a positive affective influence, various techniques, both formal and informal, were applied. For example, certificates of recognition were awarded by one instructor to those students gaining mastery on the first administration of the formative exams. In addition, the inherently supportive character of this strategy, whose essential quality is a genuine concern for each student's improvement, is discernable to students. In one vivid demonstration of this characteristic, a middle-aged female student who had returned to school after some twenty years ran to the front of the class and kissed the teacher on both cheeks upon discovering she had mastered one of the diagnostic tests.

OUTCOMES

The evidence is convincing: Mastery Learning works. It improves classroom achievement and produces a greater sense of accomplishment in both students and teachers.

Student Achievement

A summary of the final grades awarded from Fall 1972 through Spring 1974 is presented in Table 1. In each instance the control class was taught by the same instructor, had the same objectives, and used the same instructional materials as the Mastery class. The difference is the presence in the Mastery classes of the defining features of the strategy--the use of formative or diagnostic tests and the availability of prescriptive remedial materials for those students who do not achieve mastery on the formative tests. The inclusion of courses from semester to semester depended on which teachers were associated with the Mastery program and what courses they were teaching. In most cases those instructors who taught control sections in the fall semester repeated the same courses during the spring semester employing the Mastery Learning strategy.

College rules provide for the following grades at Olive-Harvey: A, B, C, D, W, R. The grade of F is no longer officially awarded. Students who fail are given a W, indicating withdrawal, and are told to try again. Even though we could not record F on the student's record, we retained the grade unofficially in our Mastery and control sections so that we might differentiate between those who actually withdrew and those who stayed but did not achieve the course objectives. The grade of R indicates an incomplete, and few were awarded. For purposes of comparison we have omitted W and R in Table 1. Later we shall examine the withdrawal rate in Mastery classes and shall note that it follows normal college frequencies.

Overall, the data presented in Table 1 favor Mastery Learning. With only one exception in the nine cases presented, Mastery is associated with significant improvement in achievement. And what is perhaps most important,

TABLE 1. PERCENTAGE OF FINAL GRADES AWARDED TO MASTERY AND CONTROL STUDENTS

	MASTERY						CONTROL						COMBINED A AND B GRADES	
	(n)	A	B	C	D	F	(n)	A	B	C	D	F	ML	Control
xxxEconomics 202	(19)	47	16	16	21	0	(24)	4	25	50	8	13	63	29
xxxBiology 111	(33)	36	33	30	0	0	(20)	10	25	60	5	0	69	35
xxSocial Science 102	(52)	13	35	21	19	12	(24)	4	21	33	17	25	48	25
xxBusiness 101	(26)	35	42	15	4	4	(18)	28	17	28	17	10	77	45
xxEnglish 101	(40)	60	20	13	5	2	(18)	17	33	22	28	0	80	50
xMathematics 112	(24)	37	33	13	13	4	(37)	8	41	35	14	2	70	49
xxSpanish 101	(29)	59	31	7	3	0	(19)	42	26	32	0	0	90	68
xxHumanities	(43)	63	30	7	0	0	(27)	15	67	18	0	0	93	82
xChemistry 121	(31)	23	23	42	10	3	(20)	15	50	15	15	5	46	65

xxx Three or more semesters' experience by the instructor with Mastery Learning strategy

xx Two semesters' experience by the instructor with Mastery Learning strategy

x Only one semester's experience by the instructor with Mastery Learning strategy

NOTE: Students in the Spanish control class were given a great deal of individual attention.

the number of D's and F's was significantly reduced in the Mastery classes. We also note that the Mastery strategy increases in effectiveness as the instructors gain experience from semester to semester. Internal improvement is characteristic of systematized effort. Accounting systems, business systems, and mechanical systems can be improved with use. The same can be true for instructional systems. But to improve one must have objectives and methods of evaluating progress toward them. The Mastery strategy provides these.

The data in Table 1 show the best results we have been able to achieve thus far in the academic disciplines cited. Even though we have been able to demonstrate the marked superiority of the Mastery Learning strategy in eight of nine academic areas researched thus far, other exceptions can be noted. Positive results were not achieved by one instructor of Accounting (Business 101) classes. Another teacher who achieved disappointing results in Economics 201 later improved significantly in Economics 202.

A revealing summary statistic is the mean final grade achieved by each group. For the Mastery students this figure was 2.96, for controls, 2.40 (on a scale where A equals 4 and F equals 0).

Another measure of achievement employed was grade achievement on final (summative) examinations. These test data, even more than the comparison of final grades, show the efficacy of Mastery Learning in achieving course objectives. In five of the six cases in which common final exams were administered to Mastery and control groups, the mean difference in achievement was significantly in favor of the Mastery students at levels of significance from .001 to .05. In the general biology course, Biology 101-111, the achievement of the Mastery students was most impressive. The Biology 101-111 final is prepared by a coordinator (not by the Mastery instructor) and administered to all students taking the course. On a 100-point final the mean scores achieved by Mastery students were 60.7 for Biology 101 and 64.4 for Biology 111. The corresponding mean scores for control students (all other students taking the courses) were 46.5 and 55.8. Not one Biology 101 Mastery student scored below a C on the final. Whereas 61 percent of the control students had scores in the D or F range.

The achievement in Biology is a fair representation of what Mastery Learning can accomplish, we feel, because the biology faculty is a "staff" in the real sense. Common objectives are agreed upon, common materials are used, and a common exam is administered. And the subject matter of biology, a sequentially structured content, is well suited to Mastery teaching.

A final comparison was made between two groups of Mastery students. Those in the first group "Met Minimum Requirements"--they took and retook formative tests and prepared for retakes by employing the prescribed correctives. Those in the other group (about 20 percent) of the Mastery students) we said "Did Not Meet Minimum Requirements." Each Mastery teacher used his own criteria in designating these students, including failure to take formative tests and being absent too often. Predictably, the achievement of the latter group was well below that of the former: a mean final grade of 2.95 for the "Mets" (on a four-point scale) as opposed to 1.96 for the "Did Not Meets." More than 80 percent of the students in Mastery classes who met minimum requirements achieved final grades of A or B. Data comparing these two groups of Mastery students with one another and with control students are presented in Table 2 and Figure 5. We might conclude tentatively that failure in Mastery classes results from non-participation. Hence, encouragement, stimulation, and motivation of the students may be as important as presenting the subject matter.

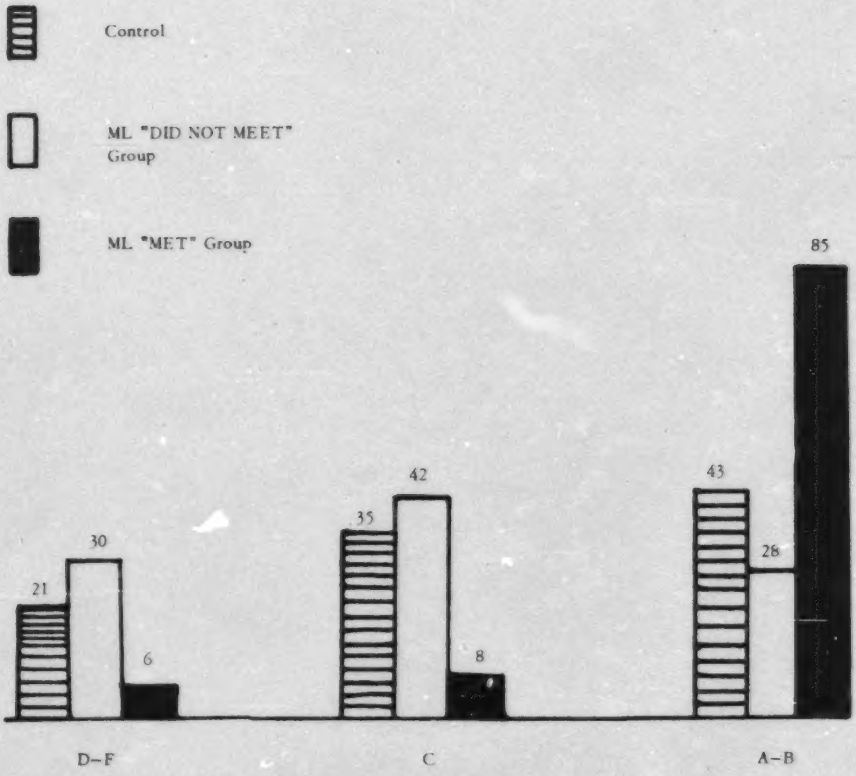
Attrition

Theoretically, Mastery Learning should hold students, since it builds on immediate successful experiences. Yet we had feared that this strategy, demanding more from the student, might precipitate early withdrawals because our students have unusually heavy job and family responsibilities, as we have pointed out. We were asking them to do more than what is called for in traditionally taught sections, in which the taking of one or two exams might be their total obligation. We were gratified, therefore, to find that the rate of withdrawal in the Mastery sections was 36.9% as compared to 37.5% overall for the same courses under non-mastery conditions.

TABLE 2. GRADE DISTRIBUTIONS IN PERCENTAGES FOR THREE GROUPS OF STUDENTS

	MASTERY STUDENTS WHO MET MINIMUM CONDITIONS						MASTERY STUDENTS WHO DID NOT MEET MINIMUM CONDITIONS						CONTROL GROUPS					
	(n)	A	B	C	D	F	(n)	A	B	C	D	F	(n)	A	B	C	D	F
Biology 111	(19)	47	53	0	0	0	(14)	7	14	65	14	0	(20)	10	25	60	5	0
Business 101	(16)	37	62	0	0	0	(10)	30	10	40	10	10	(18)	28	17	28	17	10
English 101	(36)	64	19	14	3	0	(4)	25	25	0	25	25	(18)	17	33	22	28	0
Soc. Sciences 102	(32)	19	44	16	12	9	(20)	5	20	50	30	15	(24)	4	21	33	17	25
Spanish 101	(27)	63	33	4	0	0	(2)	0	0	100	0	0	(19)	42	26	32	0	0
TOTALS	(130)	47	38	8	4	2	(50)	12	16	42	20	10	(99)	19	24	35	13	8

FIGURE 5. FINAL GRADE DISTRIBUTIONS IN PERCENTAGES FOR THREE GROUPS OF STUDENTS



A New View of Aptitude

Bloom (1974) has found that Mastery Learning reduces the validity of aptitude and general intelligence tests as measures of final achievement in a learning program. Our experience confirms this finding. The only aptitude test administered at Olive-Harvey is an English placement test--the Form R--developed and normed over many years. Its predictability has been well established; correlations of .90 have been reached between the Form R and final grades in English 101. One of our English teachers has reduced this correlation almost to zero in his Mastery classes. Another English teacher has continued to find a high correlation between a student's aptitude, or Form R score, and his final grade even in the Mastery classes; however, this correlation is significantly lower for the Mastery than for the control group.

A corollary introduced by Bloom at the 1971 annual convention of the American Educational Research Association also seems to be borne out by our experience. Bloom reasoned that if the Mastery strategy is applied, early variations in achievement among learners will tend to disappear as the learners progress; achievement will tend to equalize. Indeed this was the case in our classes. In a social sciences class, for instance, the results of the first and last formative tests were each correlated with the final examination score. The correlation of the first test with the final exam was .200, that of the last with the final was .753. In other subject matter areas such as English, Spanish, and accounting, similar trends prevailed.

The implication for the teacher, of course, is that the initial indicators of achievement are not the best predictors of what the student will be able to do at the end of the course. Teachers may well have grounds for viewing with optimism the prospect that their efforts can, indeed, have a significant positive affect on achievement.

Affective Characteristics

We administered to both Mastery and control students modified versions of the Michigan State Self-Concept of Ability in Specific Subjects Scale.

This rating scale is designed to measure change in the student's evaluation of his academic ability both in general and in specific subjects. The scale was administered at the beginning of the semester and at the end. At semester's end Mastery students rated themselves higher and showed greater positive change in their self-concept of their general academic ability. (This finding was significant at the .01 level.) There was no sigrificant difference between Mastery and control students in the way they viewed their competence in particular subjects. Though the difference with regard to general academic self-concept was statistically significant in favor of the Mastery students, in practical terms it was not impressive.

Our prejudice is that there are positive affective consequences for students in Mastery Learning programs, and we intend to devote more attention to this aspect of our study. We are aware that attitudes change slowly in adults, and we are therefore pleased that we were able to change the student's self-concept positively, even if only a little.

Additional Data

We would be happy to make available more detailed presentations of statistical data measuring the outcomes of our experimentation with Mastery Learning. Requests can be directed to us at Olive-Harvey College, 10001 South Woodlawn, Chicago, Illinois 60628.

PROBLEMS

Mastery Learning at Olive-Harvey College, in broad, general terms, has been successful. It has raised achievement levels. It has, in most respects, fulfilled our expectations. Without exception, all of us who have participated in the program have expressed a sense of satisfaction with the enterprise and will continue, with endless modifications and adaptations, no doubt, to use the strategy. This general good feeling, however, does not mean that we have not encountered a few difficulties, with their accompanying feelings of frustration and inner doubt. We think it would be valuable to be candid about those problems that seem to have given us the most trouble.

A comparison of those Mastery students who met the minimum standards described earlier with those who did not clearly and convincingly establishes the superior performance of the former. The problem obviously is to transform those who don't into doers; the obstacles seem to take three forms.

First, some students, despite our motivational efforts, exhibited less interest in high achievement than we desired. A few students professed to be only experimenting with higher education before investing in a four-year institution; and that group, it seems, equated registration and attendance with study and preparation of the assignments. Still others resisted pressures to achieve beyond the mere "passing" level. We are not disheartened by these students, however, because we realize that it takes more than a semester or two to change long established, deep-seated interests and attitudes of adults. We shall continue to explore avenues to overcome the sense of futility and despair in students who have over the years experienced a pattern of academic failure or who lack long-range goals.

Second, we often failed to provide enough time for the less successful students to engage in cooperative helping. For all kinds of reasons, good and bad, in the periods between class meetings the students spent little time on school-related learning tasks. The traditionally prescribed two or

three hours of preparation time for each class hour is, for many if not most of our students pure myth. It would seem to make more sense to modify our expectations regarding the students' use of out-of-class time and to restructure our instructional process so as to increase class time or at least the time during which student and teacher are together for instructional purposes. The intellectual involvement, stimulation, and exchange so normal a part of traditional campus life are almost totally unavailable to the typical commuting community college student, whose work and family obligations severely restrict such opportunities to those which are possible within the narrow limitations of the regular class session. If independent, out-of-class time does not bring results, it may well be that more "controlled," student-teacher contact time will. Sacrificing some breadth of coverage to provide more time for treating fewer units also seems a small cost to pay for higher achievement levels. It is a good bet that quantity can be reduced without doing serious injury to the essential course objectives.

Third, we have failed to get some of the less successful students to effectively manage more of their own learning. Students belonging to this group have not complied with the strategy's dictates. They fall in one or more of the following categories:

- They don't attend class regularly or get there on time.
- They don't spend enough time studying.
- They don't take the formative tests or retakes systematically.
- They don't do the prescribed correctives.
- They don't take sufficient advantage of the many resources at their disposal--tutors, teachers, programmed materials, A.V. materials, peers, and so on.

Having managed to isolate the major problems we face, we see two areas of lesser concern that need attention. We are very often guilty of creating unnecessary instructional difficulties by providing less than adequate student counseling and advising services. Problems are inevitable when we allow married students who have families, full-time jobs, and eighth-grade reading levels to register for fifteen credit hours of course work. Our

second concern is that some teachers permit students to take courses for which they lack the minimum entry skills yet in many cases the instructors make no provision for teaching or teaching around such prerequisites.

We also experienced some technical problems. An often mentioned source of difficulty is structuring units in sequence. We assume that learning tasks should be presented sequentially, that in mastering steps one and two students can progress to step three. However, we often find the essential or best sequential arrangement difficult to discover. In some disciplines, sequence often seems quite irrelevant or insignificant in relation to the objectives established. We have also found, contrary to our assumptions, that a gradual increase in achievement level often does not occur as the course develops. The hoped for cumulative effect of mastering formative exams is frequently not apparent. Again, we often discover that the items included in our summative exams do not correspond well either with the items in the formative exams or with the instructional time devoted to particular objectives. Summative test results may well distort or misrepresent actual student achievement when they do not accurately reflect the students' learning experience.

It is quite clear that whatever additional success we may have with the Mastery Learning strategy will depend to a considerable degree on our ability to cope with the difficulties outlined here. Especially must we develop the kinds of classroom atmosphere and student relationships that will enable the low achievers easily and without embarrassment to seek the willing assistance of their peers. And, finally, to those who may be inclined to undertake a Mastery Learning approach, it is our intention and certainly our hope that this discussion of our experience will provide a realistic perspective through which to plan and prepare a program.

CONCLUSIONS

For the past three and a half years we have been studying the effects of a "Bloom-type" Mastery Learning strategy on a random group of students and a select group of faculty at Olive-Harvey College. Results have been analyzed, thus far, in biology, business, chemistry, economics, English, the humanities, mathematics, the social sciences, and Spanish. Data are yet to be reported from architecture, black studies, electronics, nursing, and speech.

Although it has been estimated that under ideal conditions up to 95 percent of students could achieve mastery in a particular subject, published reports show that in most cases only about 75 percent of those students under Mastery Learning strategies reach the levels of achievement attained by the top 20 percent of students working under nonmastery, traditional conditions. Our objectives in undertaking this study, given our student population (described earlier), limited physical facilities, and rigid class scheduling, were fivefold: (1) to find out how well we could approximate the cognitive results obtained in other experimental settings, (2) to determine the academic subjects in which a Mastery Learning strategy would have positive effects, (3) to ascertain whether Mastery Learning might have beneficial results in the affective domain, (4) to study the effects of a Mastery Learning experience on the attitudes of teachers regarding human learning potential, and (5) to make recommendations, on the basis of our experience, to our colleagues in community colleges and other institutions of higher education, regarding the efficacy of a Mastery Learning strategy.

Level of Student Achievement Raised

The data convincingly demonstrate the superior level of achievement attained by students in the Mastery Learning classes. Table 3 summarizes the final grades awarded to three groups of students: the Mastery students who met the minimum conditions of the strategy, Mastery students who did not meet the minimum conditions, and the corresponding control groups.

TABLE 3. SUMMARY OF FINAL GRADE DISTRIBUTIONS FOR THREE GROUPS OF STUDENTS

Final Grades	(n)	Percentages A	B	C	D	F	Combined A-B Grades
Mastery Students Who Met Minimum Conditions	(130)	47	38	8	4	2	85
Mastery Students Who Did Not Meet Minimum Conditions	(50)	12	16	42	20	10	28
Control Group Students	(99)	19	24	35	13	8	43

As we explained earlier, those Mastery Learning students satisfying the strategy's minimum requirements were those who put forth the effort demanded by the strategy. Even though the criteria for the Mastery students who did not meet the minimum conditions of the strategy varied somewhat from teacher to teacher, all the students in this category failed to meet their basic obligations. The control students attended conventional classes taught by the same teachers as the Mastery classes. These instructors pursued the same objectives, using the same instructional materials, but they did not employ the special elements of the Mastery Learning strategy.

Table 3 shows that the Mastery students who met the minimum conditions made three times as many A-B grades as the Mastery students who did not meet the minimum conditions. They also achieved about twice the percentage of A-B grades that was awarded their peers in the control sections. Also significant is that the percentage of failing grades received by Mastery students who met minimum conditions was greatly reduced.

The data in Table 3 also show that the Mastery students who did not meet the minimum conditions did less well than the control groups. It seems to us, then, that our primary remaining problem is to stimulate the former group to the point where their achievement will resemble that of the Mastery students who met minimum conditions more than that of the

control group. We believe we have already offered convincing evidence to support the view that teachers may well be optimistic about the positive effects of cooperative teacher or student efforts.

Mastery Learning and the Academic Areas

At this time we cannot say definitively that a Mastery Learning strategy best lends itself to certain subjects because, as we stated earlier, some of the data presented were the product of only one semester's experience with the strategy whereas other data were based on several semesters' work (see Table 1). We do note, however, an increasing effectiveness of the strategy from semester to semester. And present indications are that with precise care in presenting instructional materials, testing, using corrective measures, and so on, the strategy will produce superior results in all academic areas.

Change in Affective Entry Characteristics

In his Phi Delta Kappa address at the 1971 annual convention of the American Research Association, Bloom made a distinction between explicit and implicit curricula. The latter curriculum teaches each student who he is in relation to others--his self-concept relative to school and school learning. He also suggested that repeated successful school experiences increase the probability of developing a positive self-concept, whereas unsuccessful experiences guarantee the development of a negative academic self-concept.

We have been able to show that the Mastery Learning strategy significantly increased, at least statistically, the student's academic self-concept with regard to general school ability. We also feel that there were positive affective consequences for learning in specific subjects, results which we were unable to measure. It is difficult to accept the notion that the achievement level increased without some, if not a proportional, increase in positive affect.

Effect on Teacher Attitudes and Behavior

We have tried to demonstrate in this paper that the adoption of a systematic learning strategy such as Mastery Learning can have profound effects on the character of the whole institution. Even in our rather limited experiences we have touched several hundred students and a sizable number of faculty members, many of them senior faculty who have influence within their respective departments.

We have seen significant changes in the cognitive behavior of our students and we have good reason, on the basis of preliminary data, to believe that these changes are accompanied by important changes in attitude and self-evaluation. Now we wish to consider some changes in teacher behavior and attitudes.

In the introduction we described what might be called a failure syndrome. People in critical situations tend to normalize them as the crisis continues. The economic crisis of the 1930s, as it lengthened, produced normal lifestyles adapted to poverty, unemployment, and failure--"Life and love on the dole." We know that the welfare system can breed a lifestyle which accepts a crisis situation as a normal one. Both recipients and giver can unconsciously conspire to perpetuate a system which becomes temporarily comfortable, if ultimately unfulfilling. So, we believe, both student and teacher can adjust to failure and be comfortable with it. We have suggested that when failure is anticipated as inevitable, the teacher's classroom behavior will reflect this expectation. Teachers can give up and be comfortable doing so. At least such behavior avoids the frustration of unfulfilled expectations, unrewarded efforts.

But under Mastery Learning, as we have suggested, a different set of assumptions manifests itself. The teacher is a facilitator of learning which he believes to be within the ability of most of his students and, more important, within his direct control. It's a new ballgame and a new payoff--not failure, but success.

We have discussed the way many of us have thought our function is to single out and certify qualified students. From that point of view we

sought to increase achievement differentials rather than to eliminate them. The normal curve as a representation of student achievement represented, if not a teaching objective, at least a respectable guideline. How else could we certify the "chosen," those who might "go on" to receive further education and the rewards which accompany it? To many teachers, particularly college teachers, the idea of retesting students on materials not mastered during the initial period of instruction would seem demeaning, academically suspect, impure. However, such attitudes fade as learning replaces an emphasis on categorizing student achievement.

Once the Mastery orientation is adopted, this function disappears. The teacher's role is to facilitate learning for all--to minimize disparity in achievement. Developing and using a variety of instructional activities and materials designed to cope with particular learning difficulties--individualizing instruction--become common practice. Furthermore, teachers find that cultivating a cooperative, mutually assisting attitude among previously fiercely competitive students becomes easier as students recognize their academic status is not jeopardized by the success of their peers. The formative and summative tests are not designed to separate the sheep from the goats. Rather they are a measure of the student's learning and the teacher's effectiveness.

This thought suggests a final benefit to teachers from Mastery Learning. We have stated that in reality teachers receive comparatively little external evaluation and cannot easily engage in professional self-evaluation. But order, system, and evaluation are built into the Mastery program. It regulates the student's behavior. He knows what he is to do and how he will be judged, week by week, unit by unit. Moreover, it regulates equally the teacher's behavior. Every lesson, every objective, every device for evaluation is manifest from the beginning of the course.

For years those administrators who bothered have tried to find a way to supervise teaching behavior, and they have failed. Now, teachers can regulate and evaluate themselves in a spirit of professional self-improvement. As one of our instructors put it, "one important advantage of the Mastery structure to the Mastery instructor, or so it seems to me, is that

he is better able than most traditionally oriented instructors to quickly distinguish what students know or don't know or what they are able to do or not do, thereby increasing his ability to diagnose specific problems and to suggest appropriate individual prescriptions." In short, we believe that teachers work better and more professionally when they have a means to continually evaluate their behavior.

Mastery Learning in the Two-Year College

Earlier we presented a somewhat detailed profile of the Olive-Harvey student population, not so much to show its uniqueness as to show its similarity to other student bodies. We believe, in fact, that our experience at Olive-Harvey promises to help solve the problem of instructing the more than two-million community college students in our country. The two-year colleges, after all, deserve special attention, for they enroll more than 40 percent of all higher education students in the United States. It is appropriate, then, that we devote a special section of this paper to Mastery Learning in these institutions.

Many of our readers are, in all probability, teachers or professionals in the field of education. Let us recall our experience as students. If the writer's experience is not unique, most of us have survived educational mediocrity and perhaps worse as undergraduates and graduate students. However, we learned, despite indifferent or even hostile conditions of instruction. We learned because, it is safe to say, most of us were eager and able students. The point is that the able student can become self-motivating and self-instructing if need be. To provide him with materials of instruction and a minimum structure for learning may be enough. Until open admissions became the battle cry, the fight was won in the office of admissions before the professor fired a shot. But, as Cross (1968) points out, the nature of the war has changed. The classroom is now the battlefield for "higher education's newest student."

Cross presents a picture of the community college student that most of us will recognize. It is hardly disputable, for instance, that on all traditional measures of academic aptitude our students score markedly

lower. The widely contrasting achievement of community versus four-year college students on SAT and ACT batteries is strong evidance. Yet our experience at Olive-Harvey has shown that expectations of student performance in our courses need not be predetermined by measures of academic aptitude. This is not to say that prior achievement and aptitude cannot be measured and do not reflect real pupil characteristics; it is merely to say that such characteristics need not and should not determine with finality student performance or our expectations (or the student's).

What about motivation for learning in community college students? Cross presents data to support her conclusion that community college students exhibit less persistence (read motivation) in learning. But the method we have employed encourages persistence. If the student lacks motivation for long-range, sustained learning tasks, our strategy confronts him with short, discrete units and frequent successes. And success breeds motivation for further learning.

Let us consider another major difference between community college students and their peers in other schools. The age, employment status, and financial responsibilities of our students make college an important but subordinate part of their lives. To expect them to initiate learning and pursue it aggressively is not realistic. But our learning is structured and paced. The student is discouraged from falling behind; his tasks are well defined, and means are provided for frequent student feedback. For these reasons, and in light of our experience with Mastery Learning, we believe it is particularly suitable to the kind of student we find in the community college.

The Future of Mastery Learning at Olive-Harvey

The Mastery Learning program is continuing at Olive-Harvey College. Those Fellows who have participated in the program thus far continue to apply the strategy to their own teaching and new Fellows have been selected who are preparing to use the strategy. Formal presentations have been made within departments, and other teachers have asked for help in applying Mastery principles to their situations. The Mastery Strategy is

spreading. Success inspires emulation and students have begun to request additional classes using this approach. We believe that the introduction of Mastery Learning will continue to cause overall improvement in instruction in our college. If that is the case, we will have accomplished what we set out to do.

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